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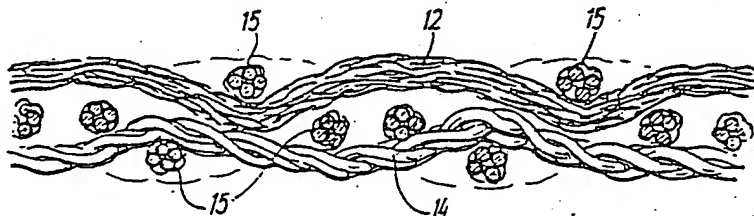
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: PAPERMAKERS FELTS



## (57) Abstract

Base fabric for use in producing a press felt on the batt-on-base type for a papermaking machine wherein a layer (11) of multifilament tow (12) is provided as an integral part of the base fabric and at that face thereof to which the batt (16) is to be applied, as by needling. In a preferred embodiment, the base fabric comprises a semi-duplex weave, and the multifilament tow (12) is provided as one of the two machine direction layers of such weave and defines one face of the resultant base fabric. There is also disclosed a press-felt embodying a base fabric as aforesaid and the method of making such press-felt.

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PAPERMAKERS FELTS

TECHNICAL FIELD OF THE INVENTION

The invention concerns papermaking machine and like clothing, and has more particular, though not exclusive, reference to felts for use in the press-sections of papermaking machines, board-making machines, asbestos cement sheet-making machines and the like.

STATE OF THE ART

Whereas felts for the press-sections of paper-making machines were originally of an entirely woven construction comprising yarns spun on the woollen system, the development of wide, open-ended needle-looms and the advancement in the variety and style of synthetic materials available has led to evolution in the construction of such felts.

As a first stage in this evolution, the same or similar woollen spun yarns were employed to weave a base structure to which was needled a batt of surface fibres. This structure provided a smooth surface to present to the wet paper sheet with a relatively open backing to provide the strength and able to provide adequate drainage. Typically in these structures the base would comprise some two-thirds and the batt would comprise one-third, by weight, of the finished felt. Although originally made largely of wool, such "batt-on-base" felts have for many years been constructed of high synthetic or entirely synthetic content blends in the

base and/or in the batt.

- More recently the availability of fine synthetic monofilament materials has led to the construction of relatively light-weight base fabrics either partly or
5. wholly from monofilament materials. These monofilaments have typically been made of polyester and/or polyamide materials of diameters in the range from 0.12mm to 0.35mm and when in the finer half of this range a number of monofilaments have been twisted together to form strong
10. fine, smooth yet flexible threads. The resultant "mesh" type of base fabric is much more open than the former structure woven from woollen spun yarns and its construction from smooth monofilament materials enables filling materials from the paper stock to pass through
15. and thereby makes the cleaning of the felts by full width showers or other devices on the papermaking machine that much easier. Adequate strength and stability is obtainable using monofilament yarns in a considerably lighter weight base cloth than proved practical with
20. spun yarns, although the requirements of the papermaking press have not allowed the total weight of the felt to be reduced by a similar amount. Typically the spun yarn base would weigh 600 to 900 g/m<sup>2</sup> in finished felts weighing 900 to 1300 g/m<sup>2</sup>, whereas monofilament "mesh"
25. base fabrics with yarns in both machine and cross-machine direction would weigh 300 to 500 g/m<sup>2</sup> in felts from 800 to 1300 g/m<sup>2</sup>.

- Thus the batt in this latter style of felt comprises some 2/3 of the weight of the finished felt,
30. whereas with a spun yarn base, the batt would typically comprise some 1/3 of the weight of the finished felt.

The use of a greater weight of batt has made it particularly practical also to make felts with a different batt blend in the centre of the felt sandwiched between

- the mesh base and the surface batt. In such a felt the surface batt will typically incorporate fibres similar in diameter to surface fibres used when a single batt blend is employed - generally in the range from
5. 6 denier to 15 denier - whereas the batt fibres sandwiched between the base and the surface batt would be coarser and in the range from 15 to 80 denier. A typical felt with a monofilament mesh base would have 10 denier fibre in the surface batt and 40 denier fibre between
  10. the surface and the base, the objective of the coarser felt centre being to allow the easier passage of filling materials and to impart extra resilience due to the more springy nature of the thicker fibres.

- In parallel with the development of felts with
15. lighter weight mesh bases, the papermachine presses on which felts are used have become faster and are operated with harder press rolls and at higher nip pressures. These more exacting conditions tend more readily to show up any irregularities around the length of the felt and
  20. can lead to an undesirable "bumping" or chatter of the press rolls.

- In this latter regard, the increased batt content of the felts with monofil base fabrics has caused problems because it is more difficult to produce a
25. sufficiently regular batt of fibres than it is to produce a regular woven structure. In particular, the difficulty in producing a regular batt of fibres increases with the coarseness of the fibres. There is, therefore, more tendency for press bumping to take place in demanding
  30. applications when employing a lighter weight base fabric with a greater batt weight, although the water removal properties and their inherent facility for keeping clean make felts with coarse denier fibres sandwiched between the surface fibres and the base fabric particularly



acceptable for a wide range of papermaking applications.

- The primary object of the invention is to provide a felt wherein the advantages arising from the presence of coarse denier fibres in the centre of the felt are preserved even in the context of the more demanding presses and the need, in such context, for increased regularity in order to cope with the very high specific line pressures, although the invention is by no means confined to felts for use in connection with such demanding conditions.

#### DISCLOSURE OF THE INVENTION

- According to one aspect of the invention, there is proposed a base fabric for use in the manufacture of a batt-on-base type papermaker's felt, the said base fabric comprising a coherent base structure and a layer of substantially twist-free multifilament tow formed integrally therewith and provided at a face thereof to define an outer surface of the said fabric.

- According to another aspect of the invention, a papermaker's felt comprising a coherent base fabric and a fibrous batt needled to such fabric is characterised in that that face of the base fabric to which the batt is applied is defined by substantially twist-free multifilament tow, the said tow being embodied in the base fabric during the formation of such fabric.

- According to a still further aspect of the invention, there is proposed the method of producing a papermaker's felt of the batt-on-base type, characterised by the step of incorporating a layer of substantially twist-free multifilament tow in the base fabric during the manufacture thereof, the said multifilament tow existing at and defining an outer surface of the base fabric and the batt being needled to the said outer surface.



The base fabric will usually comprise a woven structure in which the tow is embodied as an integral part thereof.

In carrying the invention into effect, it is

5. proposed to use coarse fibres within the range of 20 to 80 denier, and typically of 40 denier, assembled together to form a coarse multifilament tow of continuous filaments containing either no twist or such very small amount of twist as does not prevent the tow
10. from spreading out to separate the individual filaments one from the other and fulfil the same function as fibres of a similar diameter disposed in the batt of a felt.

- In order to dispose these filaments in the most
15. regular manner possible in the felt, the tow is woven into the surface of a base cloth in such a way that it can spread so as substantially to cover the surface of the base fabric.

- Coarse filaments introduced as tow at the face of
20. a woven base cloth can be much more regularly arranged than can fibres of similar diameter be prepared into a batt and then needled into the surface of a base fabric. In addition, whereas the base yarns in a conventional monofilament base do not lead themselves to the easy
  25. attachment of batt fibres by needling, the provision of an even layer of coarse filaments at the surface of the base fabric improves the facility with which a batt may be attached to that surface by needling.

- In a typical example, a base fabric containing
30. yarns of twisted and/or single monofilaments in the intended machine and the cross-machine directions of the papermaking machine and incorporating in its surface and substantially covering its surface a layer of virtually twistless tow containing individual filaments





of 40 denier will weigh about  $580 \text{ g/m}^2$ . For exacting applications on presses with very high specific line pressures, the total felt weight will be around  $1300 \text{ g/m}^2$ .

Thus we have, for such an application increased the base

5. cloth weight from around  $470 \text{ g/m}^2$  to  $580 \text{ g/m}^2$  and reduced the batt weight from around  $830 \text{ g/m}^2$  to  $720 \text{ g/m}^2$  with a commensurate improvement in critical felt uniformity.

Generally, the weight of the coarse continuous filamentary tow will not be less than  $100 \text{ g/m}^2$  of

10. finished felt, whilst the weight of the woven base fabric will comprise not less than 45% by weight of the finished felt.

The components of the base fabric additional to the continuous filamentary tow are monofilaments of

15. not less than 0.12mm average diameter, which monofilaments may or may not be twisted together.

Preferably, the coarse filaments will be woven into the surface of the base fabric in alignment with the intended running or machine direction of the felt

20. on the papermaking machine, although the invention is not limited to such disposition of the coarse filaments in that the benefits of the invention are thought likely to arise from the inclusion of filamentary tow in either or both of the machine and cross-machine directions
25. of the felt for the subsequent attachment thereto of a batt of filamentary material.

The layer of surface fibres needled to the base fabric will usually comprise fibres averaging between 6 and 18 denier, and preferably averaging approximately

30. 10 denier, although coarser fibres may be used if specific circumstances require.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described further, by way of example only, with reference to the accompanying



diagrammatic drawings which illustrate one embodiment thereof and in which:-

- Fig. 1 is a cross-section taken in the running, or machine, direction of a base fabric constructed in accordance with the invention;
5. Fig. 2 is a cross-section of the base fabric shown in Fig. 1 taken in the cross-machine direction; and
- Fig. 3 is a view corresponding to Fig. 1, and
10. shows the base fabric of Figs. 1 and 2 as embodied in a papermaker's press felt.

BEST MODE OF CARRYING OUT THE INVENTION

- Referring now to the drawings, and particularly to Figs. 1 and 2 thereof, a base fabric for use in the
15. production of a press-felt for use in the press-section of a papermaking machine comprises a semi-duplex weave structure of which one machine direction layer 11 comprises 22 threads per inch of continuous filamentary tow 12 each of some 2400 denier in which the individual
20. filaments are of 40 denier, while the other machine direction layer 13 comprises 22 threads per inch of 0.20 mm diameter nylon monofilament yarns 14 twisted two-ply and then three-ply. The cross-machine direction yarns 15 are 0.20 mm diameter nylon monofilaments
25. twisted two-ply and again two-ply and spaced at 21 threads per inch. Following heat stabilisation, the woven base fabric 11 is subjected to a needling process in order to attach to its tow-faced side a batt 16 (see Fig. 3) of 10 denier nylon fibres which form the
30. surface of the felt. The felt is finished by washing, drying and heat-setting following which it comprises  $630 \text{ g/m}^2$  of base fabric and  $620 \text{ g/m}^2$  of batt fibre.

In a second example the machine direction layer 11 comprises 20 threads per inch of continuous filamentary

tow 12 each of some 4800 denier in which the individual filaments are of 40 denier, while the other machine direction layer 13 comprises 20 threads per inch of 0.20mm diameter nylon monofilament yarns 14 twisted

5. two-ply and then five-ply. The cross-machine direction yarns 15 are 0.20mm diameter nylon monofilaments twisted two-ply and again two-ply and spaced at 21 threads per inch. Following heat stabilisation, the woven base fabric 11 is subjected to a needling process
10. in order to attach to its tow-faced side a batt 16 (see Fig. 3) of 10 denier nylon fibres which form the surface of the felt. The felt is finished by washing, drying and heat-setting following which it comprises  $900 \text{ g/m}^2$  of base fabric and  $400 \text{ g/m}^2$  of batt fibre.

15. The invention is not limited to the exact detail of the embodiment hereinbefore set forth, since alternatives will readily present themselves to one skilled in the art.

- Thus, although for convenience, the embodiments
20. disclosed are endless woven fabrics, wherein the weft yarns of the fabrics, as they exist in the weaving loom, extend in the running or machine direction in the papermaking machine, the invention is also of application to flat woven fabrics.

25. Whilst the invention has been described in the context of a semi-duplex weave, such invention is also of application to other weave structures, whether of single or multi-layer type.

- It is to be understood, of course, that although
30. reference has been made to the provision of multi-filamentary tow at a surface of a coherent woven base fabric comprising monofilament yarns, the base fabric may itself comprise multifilamentary tow in either or both of the warp and weft directions thereof.

Furthermore, whilst reference is made to the provision of filamentary tow at one face of the base fabric, it is to be understood that, in the event that a batt is to be applied to each surface, such filamentary tow may, if desired, exist at each face of the base fabric.

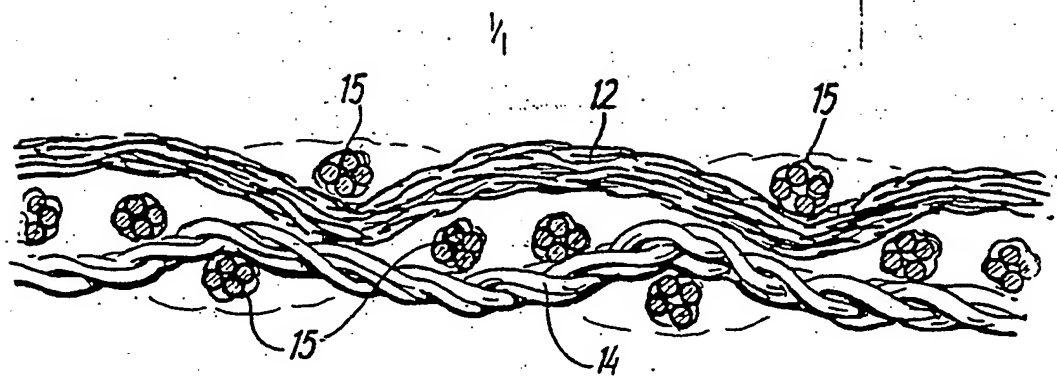
Claims:

1. A base fabric for use in the manufacture of the batt-on-base type papermaker's felt, comprising a coherent base structure (14, 15) characterised by a
5. layer of substantially twist-free multifilament tow (12) formed integrally therewith and provided at a face thereof to define an outer surface of the said fabric.
2. A base fabric as claimed in claim 1, further characterised in that said base structure (14, 15)
10. comprises a woven structure, and the tow (12) is woven integrally therewith.
3. A base fabric as claimed in claim 1 or 2, characterised in that said fabric comprises a multi-layer fabric having at least two layers of yarns (12,
15. 14) extending in a first direction and at least one layer of yarns (15) interweaving therewith, one of said layers of yarns (12, 14) which extend in said first direction being constituted by multifilament tow.
4. A base fabric as claimed in claim 3, characterised
20. in that said fabric comprises a semi-duplex weave having two layers of first direction yarns (12, 14) and a single layer of second direction yarns (15) interweaving therewith, one of the layers of said first direction yarns (12, 14) being constituted by multi-
25. filament tow (12).
5. A base fabric as claimed in any one of the preceding claims, characterised in that said base structure (14, 15) comprises monofilament synthetic yarns.
6. A base fabric as claimed in claim 5, characterised
30. in that the monofilament synthetic yarns of the base structure (14, 15) comprise folded and twisted monofilaments.
7. A base fabric as claimed in any one of the preceding claims, characterised in that the monofilament synthetic

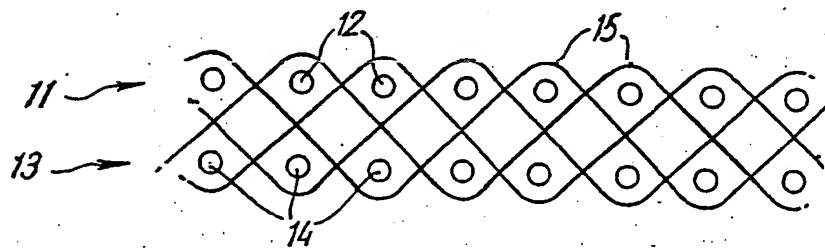


- yarns of the base structure (14, 15) are of not less than 0.12 mm average diameter.
8. A base fabric as claimed in any one of the preceding claims, characterised in that a layer of substantially
5. twist-free multifilament tow (12) is provided at each face of the base fabric.
9. A base fabric as claimed in any one of the preceding claims, characterised in that the individual filaments of the filamentary tow (12) are of approximately 40
10. denier.
10. A papermaker's felt comprising a base fabric as claimed in any one of the preceding claims, characterised by a respective fibrous batt (16) needled to one face, at least, thereof.
15. 11. A papermaker's felt as claimed in claim 10, characterised in that the fibres of the or each batt (16) are less coarse than the multifilament tow (12).
12. A papermaker's felt as claimed in claim 11, characterised in that the individual fibres of the
20. or each batt (16) are of an average denier lying in the range of 6 to 18 denier.
13. A papermaker's felt as claimed in claim 11, wherein the individual fibres of the or each batt (16) are of an average denier of approximately 10.
25. 14. A papermaker's felt comprising a coherent base fabric and a fibrous batt needled to such fabric characterised in that that face of the base fabric to which the batt (16) is applied is defined by substantially
- twist-free multifilament tow (12), the said tow (12)
30. being embodied in the base fabric during the formation of such fabric.
15. A method of producing a papermaker's felt of the batt-on-base type, characterised by the step of incorporating a layer (11) of substantially twist-free multi-

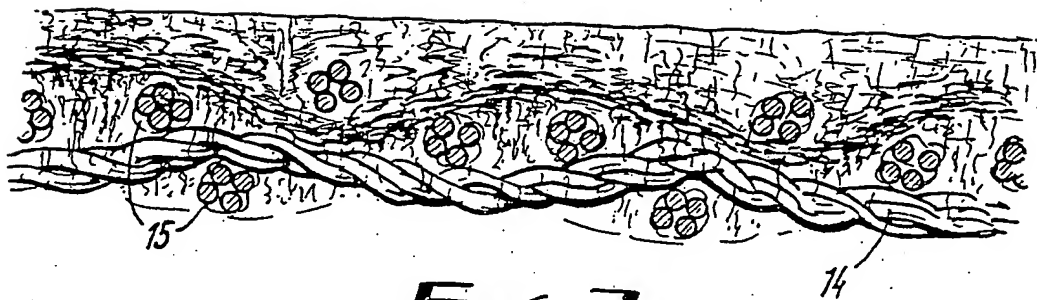
filament tow (12) in the base fabric during the manufacture thereof, the said multifilament tow (12) existing at and defining an outer surface of the base fabric and the batt (16) being needled to the said outer surface.



**FIG. 1**



**FIG. 2**



**FIG. 3**



<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate ...)		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. <sup>3</sup> D 21 F 7/08		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
Int.Cl. <sup>3</sup>	D 21 F; D 04 H	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>5</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category *	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>15</sup>
	DE, A, 1410684, published November 28, 1968 see page 1, line 11 - page 13, line 5; Kimberley-Clark	1,2,8,10,14,15
	US, A, 3094149, published June 18, 1963 see entire document, Keily	1,2,14
	US, H, 941015, published December 2, 1975 see entire document, Hoyle et al.	1,2,14
	GB, A, 732048, published June 15, 1955 see page 6, lines 62-78, Clayton	1,2,14
	GB, A, 1220531, published January 27, 1971 see page 2, lines 35-119, Nordiska Maskinfilt	1,3,4,5,7,10
	US, A, 2757435, published August 7, 1956 see entire document, Bihaly	1
	US, A, 2996786, published August 22, 1961 see entire document, Helland	1
	FR, A, 2020058, published July 10, 1970 see entire document, Nordiska maskinfilt	1
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